Morphological Control and Applications of Nanoporous Gold

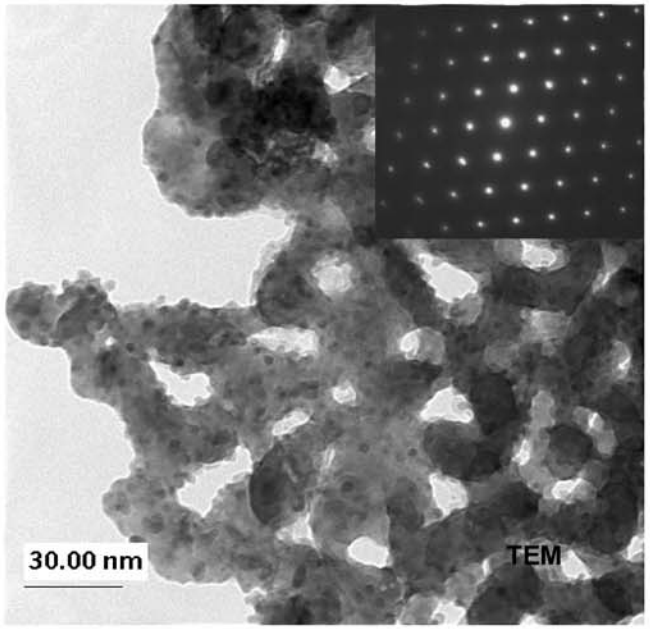
Jonah Erlebacher, Johns Hopkins University, DMR-0092756

There are a few different strategies to make ultra-high surface area catalytic materials. One way is to us nanoparticles. We have found different and perhaps better way – we coat a nanoporous gold substrate (NPG) with only a few atomic layers of Pt. In this way, almost all of the Pt atoms are epitaxially bound to an electrically conductive substrate. This new nanocomposite material has remarkable properties. It is highly catalytic, thermally stable, and can easily be integrated into important catalysis technologies such as fuel cells.

Y. Ding, Y.-J. Kim, J. Erlebacher, "Nanoporous Gold Leaf: "Ancient Technology"/Advanced Material," accepted to Adv. Mat., 2004.

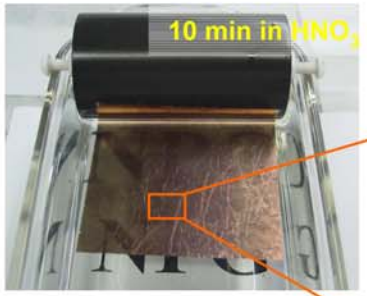
J. Erlebacher, "An Atomistic Description of Dealloying", accepted to J. Electrochem. Soc., 2004.

*Y. Ding, M. Chen, **J. Erlebacher**, "Metallic Mesoporous Nanocomposite Materials for Electrocatalysis," J. Amer. Chem. Soc., **126** (2004), 6876.*

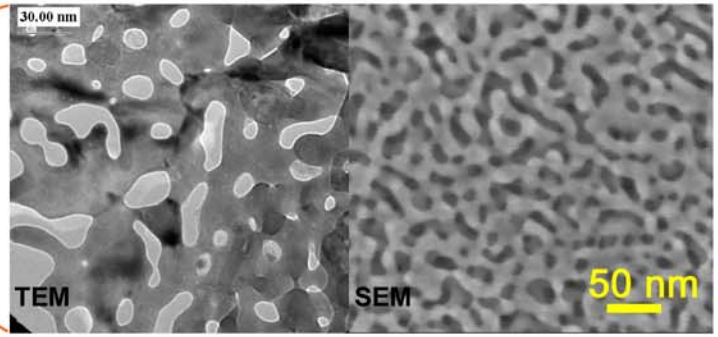


Pt-NPG: Pt plating results in a uniform distribution of Pt nanoislands eptiaxial to the NPG substrate –a novel observation of Stranski-Krastanov growth on a highly curved substrate!

White Gold Leaf:
100 nm thick
~100 cm^2 in area



NPG Leaf:
Tunable pore sizes
Very inexpensive

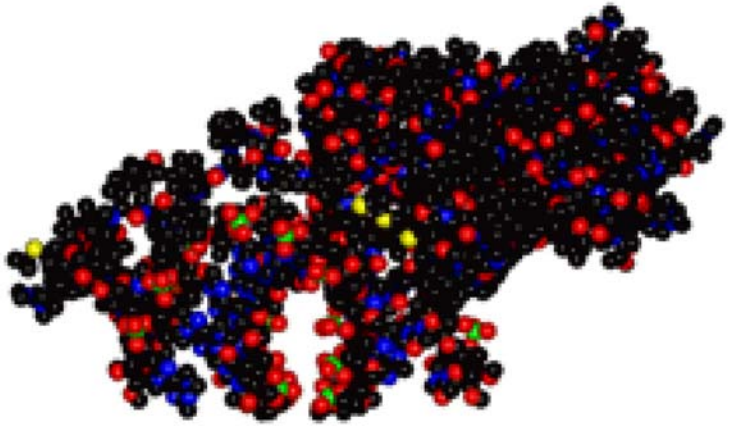


Morphological Control and Applications of Nanoporous Gold

Jonah Erlebacher, Johns Hopkins University, DMR-0092756

Education:

Three undergraduates (Jessica Bickel, Joe Lee, Dan MacNeil), three high school students (Eugene Semenov, Jonathan Talor, Alexander Rattner), and three graduate students (Yi Ding, Anant Mathur and Young-Ju Kim) have contributed to this work.

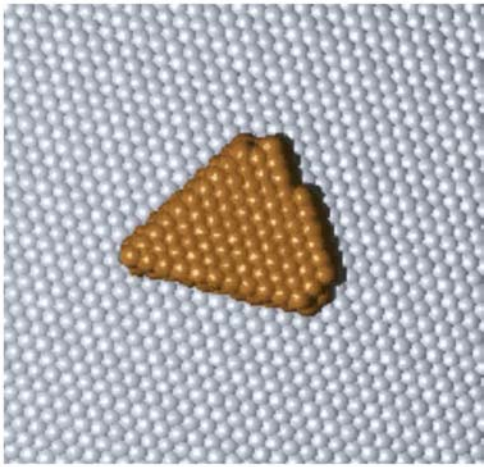


Structure of a protein bound to DNA

Nanotechnology and Materials Education:

Our freeware atomistic simulation and visualization tool, "MESOSIM" is being developed for classroom use to:

- Examine crystal and molecular structure
- Study the kinetic evolution of nanostructures



Simulation of thin film crystal growth